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MAIN EXAMINATION

SEPTEMBER –DECEMBER 2021

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

REGULAR PROGRAMME

DIT 005: FUNDAMENTALS OF OPERATING SYSTEMS

Date: DECEMBER 2021	**Duration: 2 Hours**
INSTRUCTIONS: Answer Question ONE and any TWO Questions	

Q1. Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:

Process	Burst	Priority	Arrival Time
P1	8	4	0
P2	6	1	2
P3	1	2	2
P4	9	2	1
P5	3	3	3

(a) Draw four Gantt charts illustrating the execution of these processes using the following scheduling algorithms:

i) First Come First Served **(3 marks)**

ii) Shortest Job First (Preemptive) **(3 marks)**

iii) Priority (a smaller priority number implies a higher priority) **(3 marks)**

iv) Round Robin (quantum=4) **(3 marks)**

v) What is the average waiting time for each of the scheduling algorithms above ?

(4 marks)

b) State any four elements of the process control block (PCB). **(4 marks)**

c) Consider the following snapshot of a system.

AllocationMaximumAvailable

	A	B	C	D	A	B	C	D	A	B	C	D
P1	1	2	2	1	3	3	2	2	3	1	1	2
P2	1	0	3	3	1	2	3	4				
P3	1	1	1	0	1	1	5	0				
P4	0	1	2	1	6	2	2	1				

i) Using Banker's algorithm, generate the Need matrix. **(2 marks)**

ii) Is this system in a safe state? If yes, show the sequence. **(8 marks)**

Q2. a) Distinguish the following terms:

i) Process and thread **(2 marks)**

ii) Pre-emptive and non-preemptive scheduling **(2 marks)**

iii) Logical and physical address **(2 marks)**

(b) Draw the 5-state diagram of a process from its creation to termination, including all transitions. **(8 marks)**

c) List any **SIX** functions of an operating system. **(6 marks)**

Q3. a) Consider the following page reference string:

5, 7, 6, 0, 7, 1, 7, 2, 0, 1, 7, 1, 0

How many page faults would occur with 3 empty page frames using the following page replacement algorithms?

i) Least Recently Used **(4 marks)**

ii) First-In First-Out **(4 marks)**

iii) Optimal **(4 marks)**

b) List **FOUR** strategies for handling deadlocks**.** **(4 marks)**

c) State the term that can best be described by the following descriptions.

i) The condition in which there is a set of concurrent processes, only one of which is able to access a given resource or perform a given function at any time. **(1 mark)**

ii) The process of converting logical address into physical address. **(1 mark)**

iii) A situation in which a process is ready to execute but is continuously denied access to a processor in deference to other processes. **(1 mark)**

iv) A memory management scheme that transfers the required pages into main memory but not the entire program.

(1 mark)

Q4. a) Briefly describe the role of the following schedulers.

i) Long-Term Scheduler **(2 marks)**

ii) Short-Term Scheduler **(2 marks)**

iii) Medium-Term Scheduler **(2 marks)**

b) List the **FOUR** conditions under which a deadlock situation may arise. **(4 marks)**

c) A system has four processes P1 through P4 and two resource types R1 and R2. It has 2 units of R1 and 3 units of R2. Given that:

P1 requests 2 units of R2 and 1 unit of R1
P2 holds 2 units of R1 and 1 unit of R2
P3 holds 1 unit of R2
P4 requests 1 unit of R1

Show the resource graph for this state of the system **(10 marks)**

Q5. a) Assume that the list of holes in a variable partition memory system contains the following entries (in the given order) 190KB, 550KB, 220KB, 420KB, 650KB, 110KB. Consider the following sequence of requests: A = 210KB, B =430KB, C = 100KB, D = 420KB

Determine which holes would be allocated to which request by each of the following schemes:

i) First- Fit **(4 marks)**
ii) Next-Fit (**4 marks)**
iii) Best-Fit **(4 marks)**
iv) Worst-Fit **(4 marks)**

b) Briefly describe **FOUR** benefits of threading. **(4 marks)**

END